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Customer No.: 31561  
Docket No.: 12707-US-PA  
Application No.: 10/708,876

**REMARKS****Present Status of the Application**

The Office Action rejected claims 1-11. Specifically, the Office Action rejected claims 1-11 under 35 U.S.C. 102(b) as being anticipated by Maiocchi (U. S. Patent 5,397,972). Claim 1 is rejected under 35 U.S.C. 112, 2<sup>nd</sup> paragraph. Applicants have amended independent claims 1 and 6 to improve clarity. Claims 1-11 remain pending in the present application, and reconsideration of those claims is respectfully requested.

**Discussion of Claim Rejections under 35 USC 102**

The Office Action rejected claims 1-11 under 35 U.S.C. 102(b) as being anticipated by Maiocchi. Applicants respectively traverse the rejections for at least the reasons set forth below.

1. In the present invention, it should be noted that the zero-crossing point of BEMF is specifically monitored on the floating winding while the other two windings are in the excited states. This condition is necessary. Applicants have to emphasize this condition again for at least reasons.

In the situation of the present invention, for example, when the winding C is floating, the winding A and B are conducted with current. The zero-crossing has to be detected at the floating winding. The advantages (or nonobviously unexpected results) are that the current flowing on the conducted two windings can induce the torque (moment of force), and therefore the motor does not stop due to zero torque. This is particularly useful in application when the system inertial moment is smaller and the load is larger, as to be discussed later in comparing

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*with Maiocchi.* Further in this condition of the present invention, the zero-crossing point for the conducted windings A and B never be detected because of conducting state. Therefore, only the floating winding C is detected about occurrence of zero-crossing point of the BEMF.

Independent claim 1 recited the features as follows:

1. A method for starting-up a motor having multiple stator windings and a rotor, comprising:

providing a current to two of the windings to excite a predefined initial phase and allowing one of the windings to be floating;

*monitoring a value of a back electromotive force (BEMF) induced in the floating winding*;

*from the predefined initial phase being currently excited, commutating to a subsequent phase*, which is adjacent to the predefined initial phase in a predetermined sequence of excitation phases, if *a zero-crossing point of BEMF in the floating windings occurs in the floating winding within a maximum startup time*; and

commutating to a shifted subsequent phase, which is functionally shifted by two phase-intervals from the predefined initial phase if no zero crossing point of BEMF occurs in the floating winding within the maximum startup time.

Likewise, the same emphasized features are recited in claim 6.

2. Maiocchi has claimed the motor system. Actually, the Parent Application (U. S Patent 5,343,127; hereinafter Maicocchi#127) of the currently cited reference claimed the method of starting-up. Maiocchi and Maicocchi#127 disclose the same method, as shown in Fig. 8.

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Particularly, in Fig. 8 of previously-submitted appendix, the step of disexciting motor (S102) is essential in Maiocchi. The step of disexciting motor allows any one of the windings to have zero-crossing point. In addition, since several zero-crossing points are detected, it needs the step of decoding (S107) to find the first zero-crossing point, which is any one of the three windings.

Due to this step of disexciting motor in Maiocchi, Maiocchi then detects *any one of BEMFs which are induced by the rotor on the windings of the motor* (Abstract; col. 7, lines 21-23; Fig. 8). Due to different choice on monitoring the BEMFs in Maiocchi the efficiency of start-up is not the same as the present invention.

Further in abstract of Maiocchi, Maiocchi states:

*"A method for starting-up in a desired forward-sense-of-rotation-a multiphase, brushless, sensorless, DC motor, while limiting the extent of a possible backward rotation. First, a predetermined initial phase is excited ... which would determine a "zero-crossing" in the waveform of any one of the back electromotive forces (BEMFs) which are induced by the rotor on the windings of the motor. After the elapsing of this brief impulse of excitation, the sign of the BEMFs induced in the windings of the motor are digitally read thus producing a first reading. The occurrence of a first "zero-crossing" event is monitored, and, if this happens within a preset interval of time subsequent to the instant of interruption of the first excitation impulse, the optimal phase to be excited first for accelerating the motor in the desired direction is decoded through a look-up table, and the start-up process may proceed. ..." (Emphasis added).*

3. It should be noted that the method of Maiocchi would cause the following problem when the system inertial moment is smaller and the load is larger, but the present invention does not cause the problem.

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In Maiocchi, there is no moment of force to overcome the load during the period of disexciting motor. The motor needs to maintain rotation by inertial rotation, so as to produce the back EMF being detected. When the inertial moment is small, and the load is large, in disexciting motor, it would be very easy that the motor stops due to no sufficient moment of force. Then, the zero-crossing point of BEMF cannot be detected, causing failure. This method of Maiocchi may be used in a small motor system with larger inertial moment and smaller load, so that the motor would not stop during disexciting motor period. This method of Maiocchi may cause the problem when the inertial moment is smaller and the load is larger in a large motor system.

In further discussions, the usual operation mechanism has a relation

$$\frac{dw}{dt} = \frac{T - T_L}{J},$$

wherein W is the speed of motor, T is electromagnetic rotation toque,  $T_L$  is the loading toque, and J is the system inertial moment. According to the above relation, the speed variation is determined by the quantity of  $(T - T_L)$  and the quantity of J. When it is at disexciting motor, the electromagnetic rotation toque  $T = 0$ . Since the loading toque  $T_L$  is still existing there, the speed is still reducing. The decreasing rate is determined by the loading toque  $T_L$  and the inertial moment J. When the loading toque is larger and the inertial moment J is smaller, then the decreasing rate is larger. *The motor may fast stops, causing start-up failure.*

However, the problems of Maiocchi and Maicocchi#127 as described above are at least not occurring in the method of the present invention due to the different start-up procedures. The method of the present invention is distinguishable over Maiocchi.

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4. Clearly, Maiocchi discloses that any one of BEMFs, which are induced by the rotor on the windings of the motor, is detected to look for the first occurrence of zero-crossing point of BEMF's of the three windings. Maiocchi at least does not disclose the equal features of the present invention.

Since the initial commutating condition is determined differently between the present invention and Maiocchi, the subsequent procedures have to operate in accordance with the previous condition. Fig. 8 of Maiocchi shows the different procedure from the present invention.

5. As recited the amended claims 1 and 6, clearly, the step of commutating to a next first excitation phase should be done from the predefined initial phase being currently excited. This is in operation with the previous step on monitoring the BEMF at the floating winding, so that an efficient start-up procedure can be achieved. In the present invention, it is not necessary to disexcite the motor when the zero-crossing for the floating winding is detected.

6. Differently, Maiocchi has to disexcite the motor when the zero-crossing for any one winding is detected. In other words, Maiocchi has to *diexcite* the motor and *decode* the detected BEMF ZCP signal since its excited phase are random, and it is necessary to *decide* which phase will commute to (See i.e. Abstract).

*The present invention* can directly transfer from initial phase to commutating interval *without the disexcite, decode, and decide procedures in Maiocchi*. The present invention can reduce the start-up procedure.

8. In considering the divisional Maicocchi#127, Maicocchi#127 is similar to the Maiocchi

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but one is directed to system claim and one is directed to method claim.

With at least the same foregoing discussions, it is believed the present invention is also distinguishable over Maiocchi#127, too.

9. In summary, Maiocchi fails to equally disclose the full features as at least recited in independent claims 1 and 6. It should also be noted that the little difference of the initial condition would significantly cause the different performance for the whole start-up procedure in stability and starting time period.

For at least the foregoing reasons, Maiocchi does not disclose the same starting procedure as recited in independent claims 1 and 6. With at least the same reasons, dependent claims 2-5 and 7-11 more specifically define the starting procedure over Maiocchi.

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CONCLUSION

For at least the foregoing reasons, it is believed that all the pending claims 1-11 of the invention patently define over the prior art and are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

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Respectfully submitted,



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